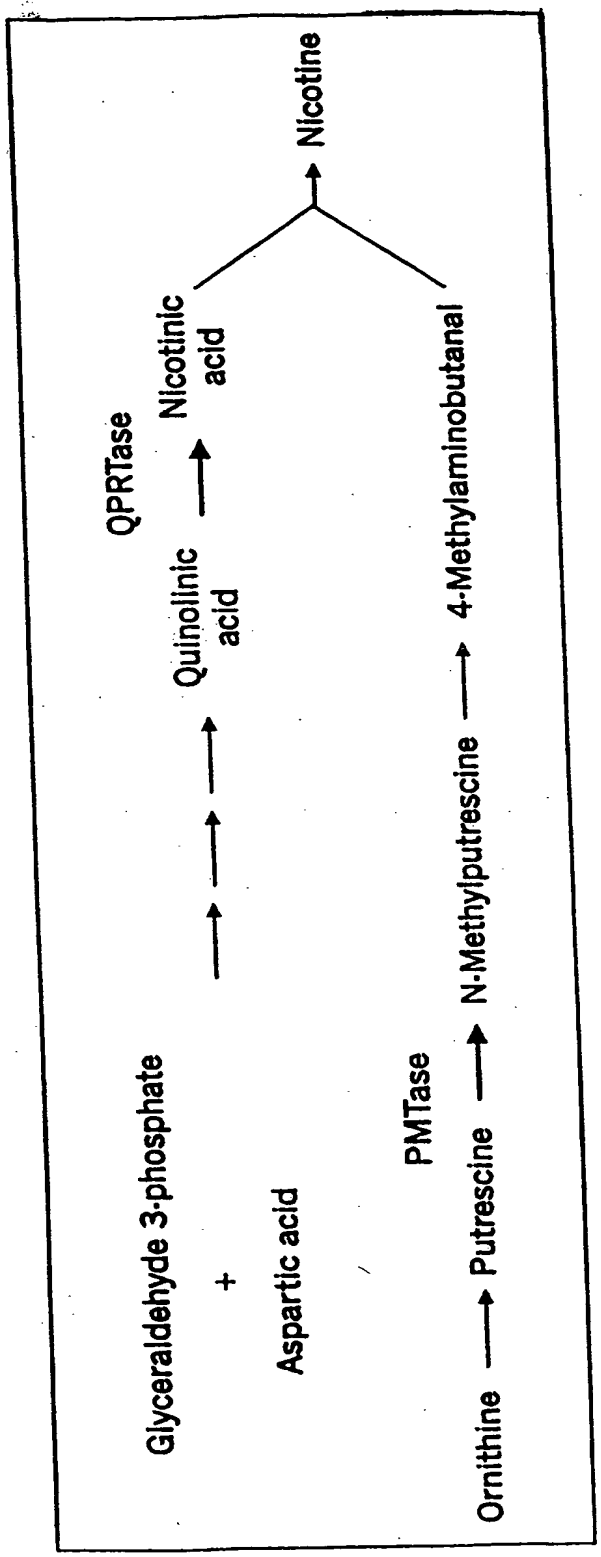
Nicotine
Nicotinic acid
QPRTase
Quinolinic acid
4-Methylaminobutanal
N-Methylputrescine
PMTase
Putrescine
Ornithine
Glyceraldehyde 3-phosphate
+
Aspartic acid

FIG. 1

```
caaaaactat tttccacaaa attcatttca caacccccc aaaaaaaaac cATGTTTAGA   60
GCTATTCCTT TCACTGCTAC AGTGCATCCT TATGCAATTA CAGCTCCAAG GTTGGTGGTG  120
AAAATGTCAG CAATAGCCAC CAAGAATACA AGAGTGGAGT CATTAGAGGT GAAACCACCA  180
GCACACCCAA CTTATGATTT AAAGGAAGTT ATGAAACTTG CACTCTCTGA AGATGCTGGG  240
TTTCTAGCAA AGGAAGACGG GATCATAGCA GGAATTGCAC TTGCTGAGAT GATATTCGCG  360
GAAGTTGATC CTTCATTAAA GGTGGAGTGG TATGTAAATG ATGGCGATAA AGTTCATAAA  420
GGCTTGAAAT TTGGCAAAGT ACAAGGAAAC GCTTACAACA TTGTTATAGC TGAGAGGGTT  480
GTTCTCAATT TTATGCAAAG AATGAGTGGA ATAGCTACAC TAACTAAGGA AATGGCAGAT  540
GCTGCACACC CTGCTTACAT CTTGGAGACT AGGAAAACTG CTCCTGGATT ACGTTTGGTG  600
GATAAATGGG CGGTATTGAT CGGTGGGGGG AAGAATCACA GAATGGGCTT ATTTGATATG  660
GTAATGATAA AAGACAATCA CATATCTGCT GCTGGAGGTG TCGGCAAAGC TCTAAAATCT  720
GTGGATCAGT ATTTGGAGCA AAATAAACTT CAAATAGGGG TTGAGGTTGA AACCAGGACA  780
ATTGAAGAAG TACGTGAGGT TCTAGACTAT GCATCTCAAA CAAAGACTTC GTTGACTAGG  840
ATAATGCTGG ACAATATGGT TGTTCCATTA TCTAACGGAG ATATTGATGT ATCCATGCTT  900
AAGGAGGCTG TAGAATTGAT CAATGGGAGG TTTGATACGG AGGCTTCAGG AAATGTTACC  960
CTTGAAACAG TACACAAGAT TGGACAAACT GGTGTTACCT ACATTTCTAG TGGTGCCCTG 1020
ACGCATTCCG TGAAAGCACT TGACATTTCC CTGAAGATCG ATACAGAGCT CGCCCTTGAA 1080
GTTGGAAGGC GTACAAAACG AGCATGAgcg ccattacttc tgctataggg ttggagtaaa 1140
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tccttcactg tgtaatcaaa caaaaagatg taaattgctg gaatatctca gatggctctt 1260
ttccaacctt attgcttgag ttggtaattt cattatagct ttgttttcat gtttcatgga 1320
atttgttaca atgaaaatac ttgatttata agtttggtgt atgtaaaatt ctgtgttact 1380
tcaaatattt tgagatgtt                                             1399
```

SEQ ID NO:1 (SEQ ID NO:3 all caps)
FIGURE 2A

```
MFRAIPFTAT VHPYAITAPR LVVKMSAIAT KNTRVESLEV KPPAHPTYDL   50
KEVMKLALSE DAGNLGDVTC KATIPLDMES DAHFLAKEDG IIAGIALAEM  100
IFAEVDPSLK VEWYVNDGDK VHKGLKFGKV QGNAYNIVIA ERVVLNFMQR  150
MSGIATLTKE MADAAHPAYI LETRKTAPGL RLVDKWAVLI GGGKNHRMGL  200
FDMVMIKDNH ISAAGGVGKA LKSVDQYLEQ NKLQIGVEVE TRTIEEVREV  250
LDYASQTKTS LTRIMLDNMV VPLSNGDIDV SMLKEAVELI NGRFDTEASG  300
NVTLETVHKI GQTGVTYISS GALTHSVKAL DISLKIDTEL ALEVGRRTKR  350
A                                                       351
```

SEQ ID NO:2
FIGURE 2B

N. tabacum	MFRAIPFTATVHPYAITAPRLVVKMSAIATKNTRVESLEVKPPAHPTYDL	SEQ ID NO. 4
R. rubrum	*--------RPNH----------PVAALS*F----AI	SEQ ID NO. 5
M. leprae	*--------LSDC----------EFDAAR--------	SEQ ID NO: 6
S. typhimurium	*--------PPRR*NPDDR*----------DALL*RINLDI*A----AV	SEQ ID NO: 7
E. coli	*--------PPRR*NPDTR*----------DELL*RINLDI*G----AV	SEQ ID NO: 8
H. sapien	*--------------D*EG*ALLLPPVTLAALVDSWLREDC*G------	SEQ ID NO: 9
S. cerevisiae	*--------------PVYE-HLLPVNGAWRQDVTNWLSEDV*S------	SEQ ID NO: 10
N. tabacum	KEVMKLALSEDAGNLGDVTCKATIPLDMESDAHFLAKEDGIIAGIA----	SEQ ID NO: 11
R. rubrum	D*AVRR**A**L*RA**I*ST****AATRAH*RFV*RQP**L**LGCA--	SEQ ID NO: 12
M. leprae	-DTIRR**H**LRYGL*I*TQ**V*AGTVVTGSMVPR*P*VIAGVDVALL	SEQ ID NO: 13
S. typhimurium	AQALREDLGGEVDAGN*I*AQL-L*A*TQAH*TVITR*D*VF----CGKR	SEQ ID NO: 14
E. coli	AQALREDLGGTVDANN*I*A*L-L*ENSR*H*TVITR*N*VF----CGKR	SEQ ID NO: 15
H. sapien	----------LNYAALVSGAGP*QAALWAKSP*VL----AGQP	SEQ ID NO: 16
S. cerevisiae	----------FDFGGYVVGSDLKEANLYCKQD*ML----CGVP	SEQ ID NO: 17
N. tabacum	-LAEMIFAEVDPSLKVEWYVNDGDKVHKGLK------FGKVQGNAYNIVI	SEQ ID NO: 18
R. rubrum	--RSAF-ALLDDTVTFTTPLE**AEIAA*QT------VAE*A*A*RT*LA	SEQ ID NO: 19
M. leprae	VLD*VF-GVDGYRVLY--R*E**ARLQS*QP------LLTVQAA*RGLLT	SEQ ID NO: 20
S. typhimurium	WVE*VFIQLAGDDVRLT*H*D***AI*ANQT------VFELN*PARVLLT	SEQ ID NO: 21
E. coli	WVE*VFIQLAGDDVTII*H*D***VINANQS------LFELE*PSRVLLT	SEQ ID NO: 22
H. sapien	FFDAIFTQL---NCQVS*FLPE*S*LVPVAR------VAEVR*P*HDLLL	SEQ ID NO: 23
S. cerevisiae	FAW*VFNQC---ELQVE*LFKE*SFLEPSKNDSGKIVVAKIT*P*K**LL	SEQ ID NO: 24
N. tabacum	AERVVLNFMQRMSGIATLTKEMAD--AAH--PAYILETRKTAPGLRLVDK	SEQ ID NO: 25
R. rubrum	***TA***LGHL*****R*RRFG*AI*HT--R*RLTC****T****GLE*	SEQ ID NO: 26
M. leprae	***TM***VCHM*****V*VAWV*AVRGT--K*KIRD****L****ALQ*	SEQ ID NO: 27
S. typhimurium	G**TA***V*TL**VASEVRRYVGLL*GT--QTQL*D****L****TAL*	SEQ ID NO: 28
E. coli	G*PTA***V*TL**VASKVRHYVELLEGT--NTQL*D****L****SAL*	SEQ ID NO: 29
H. sapien	G***A**TLARC****SAAAAAVEAARGAGWTGHVAG****T**F***E*	SEQ ID NO: 30
S. cerevisiae	***TA**ILSRS****TASHKIISLARSTGYKGTIAG****T****RLE*	SEQ ID NO: 31
N. tabacum	WAVLIGGGKNHRMGLFDMVMIKDNHISAAGGVGKALKSVDQYLEQNKLQI	SEQ ID NO: 32
R. rubrum	Y**RC***S***F**D*A*L******AVA***SA**SRAR-AGVGHMVRI	SEQ ID NO: 33
M. leprae	Y**RV***V***L**G*TAL*****VA*V*S*VD**RA*R-AAAPEL-PC	SEQ ID NO: 34
S. typhimurium	Y***C***A***L**T*AFL******I*S*S*RQ*VEKAF-W*HPD-APV	SEQ ID NO: 35
E. coli	Y***C***A***L**S*AFL******I*S*S*RQ*VEKAS-W*HPD-APV	SEQ ID NO: 36
H. sapien	YGL*V**AAS**YD*GGLVML*D**VVPP***EK*VRAARQ---AADFAL	SEQ ID NO: 37
S. cerevisiae	YSM*V**CDT**YD*SS**ML*D***W*T*SITN*V*NARA---VCGFAV	SEQ ID NO: 38

FIGURE 3

N. tabacum	GVEVETRTIEEVREVLDYASQTKTSLTRIMLDNMVVPLSNGDIDVSMLKE	SEQ ID NO: 39
R. rubrum	EI****--L*QLA***AVGGAEV-----VL****-----DAPT----*TR	SEQ ID NO: 40
M. leprae	E****S--L*QLDAM*A-EEPEL-----*L***F--*VWQTQV----AVQ	SEQ ID NO: 41
S. typhimurium	E****N--LDELDDA*K-*GADI-----*****F-----NTDQ----MR*	SEQ ID NO: 42
E. coli	E****N--L**LD*A*K-*GADI-----*****F-----ETEQ----MR*	SEQ ID NO: 43
H. sapien	K****CSSLQ**VQAAE-*GADL-----VL***F------KPEELHPTAT	SEQ ID NO: 44
S. cerevisiae	KI***CLSED*AT*AIE-*GADV-----*****F------KGDGLK*CAQ	SEQ ID NO: 45

N. tabacum	AVELI---NGRFDTEASGNVTLETVHKIG-QTGVTYISSGALTHSVKALD	SEQ ID NO: 46
R. rubrum	**DMV---A**LV*****G*S*D*IAALA-ES**D***V*******TT**	SEQ ID NO: 47
M. leprae	RRDIR---APTVLL*S**GLS**NAAIYA-G***DYLAV*******RI**	SEQ ID NO: 48
S. typhimurium	**KRV---**QARL*V*****AE*LREFA-E***DF**VG******R***	SEQ ID NO: 49
E. coli	**KRT---**KALL*V*****DK*LREFA-E***DF**V*******Q***	SEQ ID NO: 50
H. sapien	*LKAQFPSVA---VEA**GIT*DNLPQF-CGPHIDV**M*M**QA*P***	SEQ ID NO: 51
S. cerevisiae	SLKNKWNGKKHFLLEC**GLN*DNLEEYLCD-DIDIY*TSSIHQGTPVI*	SEQ ID NO: 52

		% Identity	% Similarity	
N. tabacum	ISKLIDTELALEVGRRTKRA			SEQ ID NO: 53
R. rubrum	*G*D*VVA-----PPKAERA	15.9	43.2	SEQ ID NO: 54
M. leprae	*G*DL	18.3	37.3	
S. typhimurium	LSMRFC	18.2	34.8	SEQ ID NO: 55
E. coli	LSMRFR	17.9	32.8	SEQ ID NO: 56
H. sapien	F***L---F*K*VAPVP*IH	16.8	31.7	SEQ ID NO: 57
S. cerevisiae	F***LAH	14.6	27.8	SEQ ID NO: 58

FIGURE 3 continued

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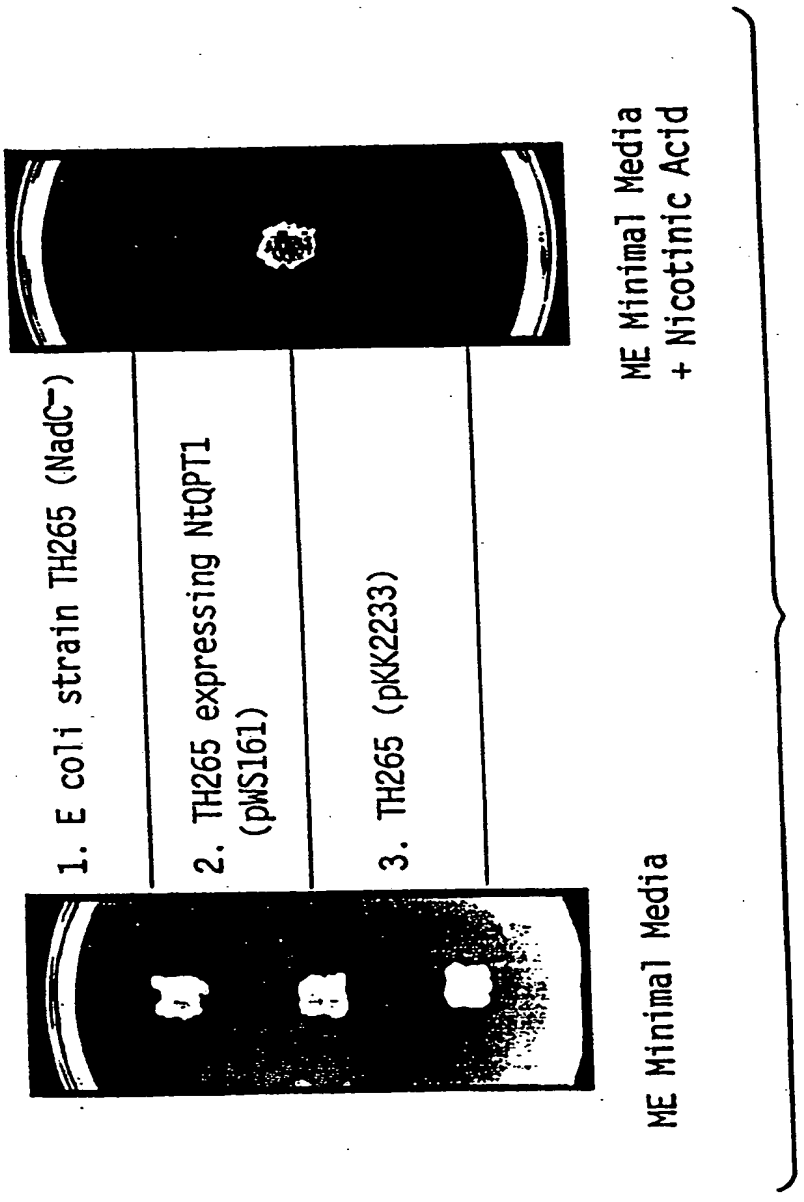
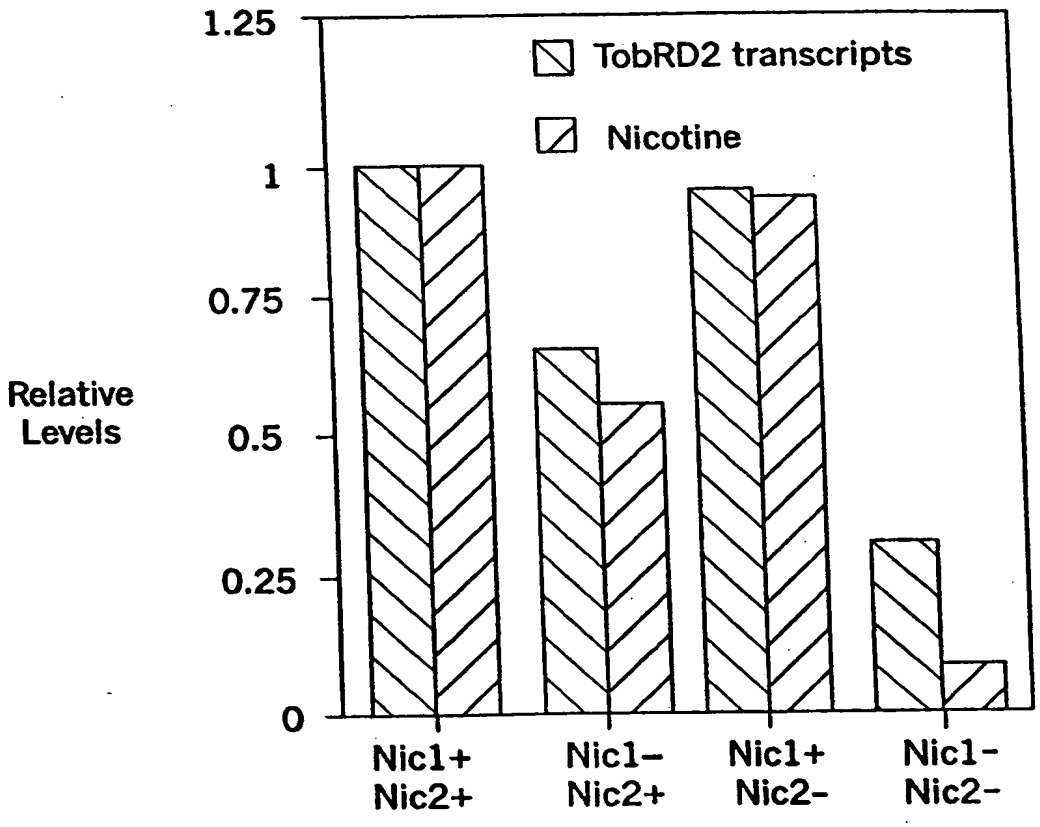


FIG.4

FIG. 5


1.25
1
0.75
0.5
0.25
0
Relative Levels
TobRD2 transcripts
Nicotine
Nic1+ Nic2+
Nic1− Nic2+
Nic1+ Nic2−
Nic1− Nic2−